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Human Resources and National Security

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Some Problems of Scientific Manpower

THERE are five preconceptions about scientific manpower that have wide currency. One stipulates that the United States is suffering from a severe shortage of scientists and engineers and that our basic security is threatened by the prospect that the U.S.S.R. may outproduce us in the number of trained personnel. A second holds that the United States is wasting a large percentage of its intellectual potential because little more than half of all the young people in the country with good native intelligence complete college. A third preconception holds that if the nation is to increase the number of able young persons who are interested in pursuing careers in science, it will be necessary to strengthen the high schools of the country, particularly with respect to their offerings in mathematics and basic science. A fourth formulation holds that the Armed Services, which have become the largest employer of manpower in the country, are conspicuously wasteful when it comes to the utilization of highly trained scientific and engineering personnel. Finally, a fifth proposition holds that any marked increase in the numbers who choose to pursue a scientific profession will depend in large measure on an alteration in the basic attitudes of the American public so that the status of scientists and engineers can be substantially improved.

These five preconceptions seem to be so obviously true as to leave little opportunity for critical appraisal. Yet closer inspection may disclose that the obvious is, after all, not quite so obvious.

It may not be out of place for an economist to begin the inspection of the theorem that we are suffering from a shortage of scientists and engineers by stressing that in a world of limited resources we are always short. There is a shortage of good baseball players, of top-flght business executives; beautiful women are in short supply; competent philosophers are likewise scarce. How could it be otherwise, then, than that there would be a shortage of good scientists and engineers? A related consideration is the arbitrariness, and in fact the fickleness, of the demand for scientists and engineers, at least for a large part of the total demand. During the last few years, the Congress of the

United States has seen fit to make available approximately $2 billion annually for research and development, an amount that is more than half of the total annual expenditures for these purposes. It is no secret that recently there has been a threat of a 20-percent reduction in the research and development budget of the Armed Forces. If such a reduction should in fact take place, much if not all the present shortage of scientists and engineers, viewed at least in gross quantitative terms, might disappear overnight. Clearly, if the Congress decided to increase appropriations for research and development from $2 billion to $3 billion, the shortages would reach astronomical heights.

What about the relative position of the United States vis-à-vis the Soviet Union in the training of scientists and engineers? Considering what we do not know about our own scientific and engineering manpower resources, comparative analyses of the United States and the Soviet Union would seem to rest on shaky grounds. To advise caution about such comparisons does not commit one to lack of concern about the magnitude and quality of the effort the Soviet Union is making to strengthen its scientific manpower resources. From the earliest days of the Communist Revolution, the leaders of the Soviet Union have recognized the importance of overcoming the scientific lead of the West and have striven to do what they could to enlarge their scientific manpower resources.

Some months ago, a leading newspaper gave emphasis to the threat of U.S.S.R. scientific superiority by detailing not only what is going on within the Soviet Union itself, but including also quantitative data on the training of scientists and engineers in the satellite countries. There is little reason to question that Hungary, Rumania, Poland, and Bulgaria are turning out varying numbers of scientists and engineers, although it is indeed questionable whether anyone in the United States has any clear perception of the true magnitude and, more important, of the quality of this effort. But this fact calls attention to the somewhat startling failure of most of the comparative studies to include on the side of the West not only the American figures but also those of Canada, Great Britain, France, Western Germany, and the other allied nations. Nor is proper weight given to the observation of a well-informed Government scientist that the Soviets are anxious to translate the textbooks and scientific treatises of the West, but that there has been little need as yet for Western translations of the scientific material available from behind the Iron Curtain.

Since the population behind the Iron Curtain is considerably larger than that of the United States, there is nothing to stop the leaders of the Soviet Union, if they are determined to do so, from raising the output of scientists and engineers above the American level. But it would be well to remember that the same power that could bring about this result also brought about an agricultural policy decision some years ago that resulted in the slaughter of perhaps as much as 50 percent of the total livestock of the country. It is possible for any country, through compulsory powers or through incentives, to increase substantially the number of trained people in any particular sector of life. What no country has yet been able to accomplish is to insure that highly competent people rise to the top in every sector of life. There were many good scientists in Germany in 1933, but that did not prevent Hitler from coming into power. To reduce all considerations of national security and welfare to concern over the number of scientists and engineers would be the rankest type of materialism. It would also be to withdraw behind an intellectual Maginot Line.

What about the second preconception, which holds that we are wasting about half of the best brainpower of the country because only about half of the boys and girls in the upper range of intelligence-test results complete college? Several points are worth noting, each one of which must be assessed before a valid conclusion can be reached about this particular thesis. About half of the most intelligent young people who fail to complete college have been so little attracted to their studies during their high-school careers that they have failed to complete secondary education in the upper fifth of their classes. It may be stated that students who are not in the upper fifth of their high-school graduating classes are poor bets for becoming outstanding scientists or engineers. Forty percent of all students who score high on intelligence tests fail to take college preparatory courses. Although they have the intellectual potential to pursue a college education successfully, they have not qualified themselves to do college work. Since the present concern with this wastage of brainpower derives largely from a desire to increase the number of students who will pursue scientific or engineering careers, it is well to note that one-half of all those who score high on intelligence tests are girls and that only one girl out of ten secures in high school the foundation in mathematics necessary for college study in engineering and science. Hence, even if many more able girls were encouraged to go on to college, it is doubtful that any significant increase would take place in the total numbers preparing for science and engineering.

It would be a serious error to overlook the fact that it would be a disservice to many individuals, and also to the country, if every person of high intelligence were persuaded to go to college. The leadership of such institutions as trade unions continues to be chosen from the noncollege group. It is clearly in the national interest to have able people compete for these posts. Although our culture places little emphasis on the arts, it would surely be a questionable national policy to exert direct or indirect pressure on the promising musician or artist to attend college when he might well develop his talents more effectively through other means.

There are unquestionably a considerable number of able young men and women who do not now enter college but who, with encouragement, financial assistance, and better guidance, might do so, and thereby more effectively develop their potential and be in a better position to make a significant contribution to the nation. The point of the foregoing analysis has been to challenge the assumption that we are wasting 50 percent of our brainpower.

One of the most salutary effects of the recent preoccupation with the supply of scientists and engineers has been to focus a new spotlight on the state of secondary education. Appalling conditions have been revealed. No mathematics is taught in one-quarter of the high schools in one southern state. In many parts of the country, it is usual for the football coach to teach science as a secondary duty, since science is a man's subject. The recent efforts of the American Association for the Advancement of Science and other groups to seek remedial action are to be commended, but it seems unlikely that any significant improvement can take place in the short run.

The problem is not limited to science and mathematics in high schools, but involves the whole status of high-school teaching. Consider for a moment the contrast between the circumstances of our high-school teachers and the status in the community, the salary, and the opportunity for meaningful work that were accorded to the *Gymnasium* professor in pre-Hitler Germany. It may not be out of place to mention in this connection that it would hardly be a national gain for high schools to strengthen their instruction in science and mathematics and neglect to improve the teaching of English and history. A society of technically trained illiterates is no desideratum. From the viewpoint of public policy, this renewed interest in the status of secondary education must not be permitted to become an unbalanced preoccupation with one area of secondary education. Rather, it must be used as leverage to improve the quality of secondary schools across the board. Considering the tremendous stress that schools will soon be under because of rising enrollments, any substantial improvement is likely to come, at best, very slowly.

The fourth preconception singles out the Armed Services as a major waster of trained manpower. The typical formulation runs as follows: Unless the Armed Forces have need for a chemical engineer or physicist, they should defer him so that he can pursue his specialty in civilian life rather than waste his time, and more particularly his skill, in the performance of military duties. If this contention were limited to men with a Ph.D. degree who were needed for research, teaching, or defense work, it could be soundly defended. But it is often applied indiscriminately to the tens of thousands who receive bachelor's degrees in one of the sciences and obtain positions in industry that have no relationship to defense effort. One aspect of the problem that is seldom considered is the likelihood that in many instances the individual will be able to develop his full potentialities more through a tour of duty with one of the Services than through a 2-year assignment at the drafting board in a large corporation's engineering department.

But all of these considerations of efficiency aside, it is well to remember that we are citizens first and scientists and engineers second. In periods of full mobilization, it is obviously necessary to use every man at his highest possible skill, but at a time like the present when we are devoting but a small part of our total national effort to defense, considerations of equity cannot be lightly ignored. The economy depends on skill, but democracy depends on more than skill.

The fifth and last preconception stresses the importance of a change in basic values in favor of science and the scientist, without which no substantial increase in the number of young people who pursue a scientific career can take place. In simple terms, the proponents of the position argue in favor of an increase in the income and prestige of the scientist. Alterations in the basic values of a community are always hard to bring about, particularly in the short run. But the question must be asked whether any real effort should be made to bring about this change in favor of science alone. What about the other important human activities that have such difficulty finding a place in the sun—the humanistic, the artistic, and the religious activities? Is it not equally important from a national point of view to deepen the American public's understanding and appreciation of the artist, the writer, the man of God? Why single out the scientist or the engineer?

There is probably much that could be altered for the good if some of the national energy that is now devoted to the making of goods and money could be deflected to other ends. But to establish as a primary end quantitative increases in the number of scientists and engineers hardly seems a worthy national objective of and by itself, important as it may be within the context of the larger goal of stressing the intellectual rather than the practical in national life.

If we are dissatisfied with quantitative approaches to the problems of scientific manpower, what other approaches should be pursued? It would be well to start with a consideration of the nature of the scientist. Two years ago the National Manpower Council published its report on *A Policy for Scientific and Professional Manpower*. Included therein is a chapter on the physicist that benefited greatly from the ideas of Lee DuBridge, a member of the council. DuBridge emphasized the subtle combination of qualities required in a good physicist: a high order of general intelligence, a special interest in mathematics, a tolerance for indeterminate solutions, and finally, an emotional involvement with the subject matter of physics proper, which he best described as a state similar to "falling in love." Clearly, the development of a larger number of competent scientists is very much more than a technical matter such as is involved in raising the production of steel or of automobiles. We are not dealing with what the economists call freely reproducible goods. The beginning of wisdom is to recognize the inherent limits set by the order of qualities required.

In a recent issue of the *Harvard Alumni Bulletin*, Lawrence Kubie, the distinguished psychoanalyst, discussed how the weak financial position of the universities is discouraging young people from pursuing careers in research and teaching. He stressed the fact that it is impossible for the young scholar and scientist to maintain a standard of living that does not place undue burdens on his wife and children. Although Kubie does not make the point, it has seemed that we have been shadowboxing for many years now with respect to the financing of higher education. At present, selected universities receive about $400 million annually from the Federal Government for research and development work. They feel free to take this money because it is for contract work, while they would have qualms in asking for a general Government subsidy. Yet it is widely recognized that many assignments on Government contracts deflect people from important to less important problems, from areas of primary concern to areas of peripheral interest. Moreover, contract funds are not a sound basis for providing the long-term security and perquisites that are the key attractions to the university scientist and scholar, who above all wants a balance between teaching and research with the freedom to determine the directions of his own work.

Another point worth raising is the probable distortion that has come about in scientific effort as a result of the international situation, which it would be insane to ignore and yet foolhardy to respond to without balance and circumspection. Most Government research funds are spent on applied research and the practical development of new weapons. Relatively little is spent on the basic research that is the necessary foundation for radical future alterations in civilian as well as military technology. One acute observer has remarked that we have a shortage of first-rate men to work on second-rate problems.

A fourth factor, little recognized, grows out of the trend toward a younger age of marriage. At present one out of every four girls is married at 18, and more than half are married before 21. What is more, couples tend to have their children during the early years of marriage. As a result, a young man who, in the 10 years after acquiring his doctor's degree, should be concentrating on deepening his knowledge and skills is likely to be harassed by mounting family expenses. To an alarming degree, the abler young people are leaving the university for greener pastures in industry, with the result that the teachers of the next generation and those with primary responsibility for basic research may soon represent second- and third-best talent, rather than best talent.

A fifth factor worth stressing is the difficulty in a large country such as the United States where there is a penchant for organizational activity of not interfering with the effective performance of outstanding scientists. Wesley Clair Mitchell, a remarkably disciplined scholar, was appalled to note at the end of every year what a high proportion of total working time had been deflected from his basic research. And the testimony of Einstein was to the effect that the atmosphere in the United States is not conducive to reflective thought.

These are but a few of the neglected factors that clearly help to determine the quality of scientific manpower and the effectiveness with which it performs. Imbedded in the foregoing analysis are at least three major policy determinations that the nation must make in the immediate future.

With bulging enrollments at both the high-school and college levels, we must begin to face the question of what we want high schools and colleges to do. Should the high school remain a common school where the instruction is geared to the average student? Should all who want to go to college and who possess the minimum intellectual qualifications be admitted? Or should we try as a people to make a more self-conscious determination of the additional resources that we want to make available for educational purposes and to consider more critically than we have in the past the most effective way of using such resources to insure, not an increase in the number of years that people spend at school, but rather an increase in the effectiveness of each year that a person is in school in terms of knowledge gained and skills acquired.

A second very difficult question that awaits evaluation, if not solution, is the changes that are called for with respect to the fuller development and more effective utilization of the potential of American women, who represent the majority of high-school graduates and a high percentage of college graduates. If there is serious concern about increasing the number of highly trained persons in our society, we should recognize that women represent the greatest potential supply.

Finally, there is a need to appreciate fully the crucial role of the university in producing both new scientists and new scientific knowledge. In this area, there are at least three major problems: more adequate financing of higher education, keeping enough distinguished scientists in the universities, and determining a proper balance between basic and applied research. These problems cannot be solved apart from each other, nor can they be solved by the universities alone, for the actions of industry and government have a profound effect on each. Until this strategic area is seen as a whole and until a sound and imaginative program for the strengthening of the universities is developed, improvisation will continue. When forced by poverty to improvise, no university community can make its maximum contribution to society.

The solutions to these and allied problems will not be easy to come by. In a democracy, a role will be played by the legislator and the general, as well as by the industrialist and the university administrator. But the real challenge is directed to the leaders of science. It behooves them to be worthy of their position, to eschew the temporary and expedient, and to show the hallmark of true leadership by contributing sound analyses and presenting solutions worthy of the great tradition of which they are the contemporary spokesmen.

Manpower Requirements of the Military Establishment

It is necessary in analyzing problems of military manpower to determine what manpower is required to win a war that may have to be fought or what is required to establish positions of strength in prewar or cold-war conditions, rather than to dwell on the purely organizational needs of the military establishment. Our military establishment was completely lacking in formulated ideas concerning its needs in manpower, raw or trained, at the beginnings of World War I and World War II. It was not prepared in 1917 for the war of position that was foreshadowed in 1914, nor was it prepared for the war of movement—blitzkrieg—in 1939–1940. The Eberstadt Report indicated that inadequate attention was given to the manpower aspects of mobilization and that realistic plans for effective over-all allocation and utilization of manpower did not exist.

The general neglect of manpower was also evident in the lack of plans for industrial mobilization. The Assistant Chief of Staff, G-1, was responsible for military manpower, and the Assistant Secretary of War was responsible for industrial mobilization. The responsibility to provide the manpower to make the weapons, munitions, and equipment needed by the Armed Forces was unassigned—and at a time when the Armed Forces were taking the younger workmen into service. The industrial mobilization plans even up to 1939 were devoid of adequate manpower provisions, although Enoch Crowder, in his report as provost marshal general in World War I, clearly indicated the need.

Military manpower requirements are now determined annually after consideration by numerous agencies of the Federal bureaucracy from the National Security Council down. The problem is settled, of course, by the Congressional appropriations. One wonders whether this entire consideration is not in terms of existent (or competitive) organizations instead of in terms of a functional use of manpower if and when needed. The military itself might admit that this method is inadequate for determining manpower requirements, and the Congress might believe reasonably enough that the military consideration of the problem is static rather than dynamic and functional. How deeply the general manpower problem is involved in the aggregate population, however, has been overlooked in the narrow conceptions of compartmentalized-thinking on military manpower. The realistic solution by means of the budget does not appear to be a solution of the actual military manpower problem, although it might be a solution of the immediate political problem.

Clarity requires that the concept of "military" be cast in a rather broad outline. It is not merely that of the combat soldier. The Hoover Commission classifies personnel for "military activities" as follows: (i) personnel for the military activities, (ii) personnel for the combat-related support activities, and (iii) personnel for the supplier-related activities. The military activities include combat, combat training, and other activities of a miltary operational character. The combat-related support activities are concerned with logistic support such as procurement and supply, transportation and communication, materiel maintenance, and care of combat personnel. Personnel in these types of activities can be interchanged with those of the fighting forces and can accompany them forward to combat zones. The supplier-related personnel include those who possess most of the skills employed in the civilian economy and who are oriented toward business, industry, science, and the professions. They do not need to accompany the fighting forces into forward combat areas and are reasonably stable in location.

The concept of "military" is complicated by the existence of women in the military services. The functions they perform are not combat services. The question has been raised whether civilian women could not replace many military personnel in the Department of Defense. The Hoover Commission has alluded to this problem as a unique personnel problem in the Department of Defense with reference to military and civilian personnel who work together without clear delineation of the role appropriate to each.

The basic distinction between civilian and military personnel is not sharp and is often difficult to recognize. The popular conception identifies "military" with "combat." In World War II, it was impossible to obtain a definition of combat troops. All in uniform were at first thought to be, potentially at least, combat troops, but the presence of women in the military services showed that this was not true. The fact that civilian and military personnel do the same work has blunted the distinction between them. The fact that civil defense will undoubtedly require the invoking of martial law (under the military authorities) still further invalidates it. And it must be remembered that the American Armed Forces in wartime are primarily composed of civilians in uniform.

Manpower obviously includes womanpower—our greatest reserve of human power that can be used to meet the needs of a war economy. The usual definition of manpower is the number of people over 14 years of age who are capable of doing useful work. In this form, population statistics are sometimes compared nation against nation, bloc against bloc. But the level of gross raw statistics tends to mislead. To think of manpower in national totals—whether for the military, industry, or the supporting civil economy—is to indulge in a statistical mirage. Little is actually known about the comparative situations of two nations if one has merely the knowledge that they each have a population of 1 million. If armed hordes were fighting armed hordes, such figures might have some significance. But in technological war, the quality of the manpower increases in importance. Numerical figures must be interpreted in terms of the character of the nation itself. For example, a nation in an advanced stage of industrial and technological development has a tremendous advantage in manpower potential. Other important factors, in addition to the stage of industrialization, are the maturity of the labor movement and its leadership; the national character; the public attitude toward war and conscientious objectors; minority groups and their psychology; the attitude toward expending human life; educational, apprentice, and technical training of the people; the stage of scientific research and development; the strength and amount of infiltration by subversive movements; and the age, sex distribution, and health of the population.

The basic manpower requirement is that manpower necessary to insure victory in war. There must be a strategic plan based on full research, intelligence, and imagination to meet all the potentialities of the assumed enemy and its allies. This plan, in part, will be conditioned by the commitments of foreign policy. If this policy has been one of appeasement and half-hearted preparedness, politics will have been played with manpower and diplomats will have permitted the development of a situation that requires either supine surrender or a high cost in manpower for belated courage and wisdom. To paraphrase Clausewitz, war is only a continuation of politics by a different means; it has its own grammar but not its own logic (*1*).

Manpower (that of ourselves and our allies) must be determined in the present situation by the strategic plan for meeting the U.S.S.R. and its allies at the decisive moment. Tactical plans will make manpower requirements more specific, but these plans will develop up to the time of battle. Requirements must be interpreted not in terms of organizations or in a vacuum, but in the dynamic terms of a function—the function being the implementation of a strategic plan (*2*). Manpower is the central factor in such implementation and tactics makes it more definite. But strategy—grand strategy—is a function of both politics and the military.

An important part of the manpower problem is the principle of the military-industrial balance—or, in its widest sense, the military-civilian balance. The principle is illustrated simply. Every time a man is placed in military service there must be provision for feeding, clothing, housing, transporting, and equipping him. Every time a man is kept in industry or in the civil economy there is a man who does not go into military service. By this balance is obtained the optimum number of men that can be placed in military service together with the provision for all means to make him effective in terms of the capacity of the nation. This is the military-industrial balance. But the men in industry too must be fed, housed, and clothed, and these functions are performed by the rest of the civilian economy. The farmers, for example, feed the military, the industrial personnel, and all others, including themselves. In this sense, there is a balance between the military organization and all its supporting activities. This broader balance is the military-civilian balance.

A major problem in military manpower is the age of military effectiveness. In previous wars, the obligation of military service was placed on all male persons between the ages of 18 and 45 who were citizens of the United States or who declared their intention of becoming citizens. In World War I, although the obligation of military service included the 18-to-45 age group, the first registration was for ages 20 to 30. At later registrations, the age limit went down to 18 and up to 45. In World War II, the changes of attitude on the part of the Armed Services concerning the acceptable age for military service may be indicated as outlined in Table 1.

Table 1. Age and military manpower in World War II.

Age	Date	Authority
Persons liable for registration		
21–35	16 Sept. 1940	Public Law 783, 76th Congress
18–64	20 Dec. 1941	Public Law 360, 77th Congress
Actual registrations		
21–35	16 Oct. 1940	President's proclamation
21	1 July 1941	President's proclamation
20–45	16 Feb. 1942	President's proclamation
45–65	27 Apr. 1942	President's proclamation
18–20	30 June 1942	President's proclamation
18	1 Dec. 1942	President's proclamation
18	Continuing on birthday beginning 1 Jan. 1943	President's proclamation
Persons liable for service		
21–35	16 Sept. 1940	Public Law 783, 76th Congress
21–27	16 Aug. 1941	Public Law 206, 77th Congress
20–44	20 Dec. 1941	Public Law 360, 77th Congress
18–44	13 Nov. 1942	Public Law 772, 77th Congress
20–35	14 May 1946	Public Law 379, 79th Congress
Persons acceptable for induction		
18–37	5 Dec. 1942	Administrative Action
18–25	15 Aug. 1945	Administrative Action
20–25	16 May 1946	Administrative Action

The restriction of inductees to a narrow age group centering around the twenties has greatly complicated the manpower problem in wartime. For example, this conclusion regarding the desirable age for the Armed Services, which developed as World War II progressed and was not set as initial policy, permitted large numbers of the military age grouping to take jobs in industry. By successive 6-month deferments, these persons became "nominal" or real experts and presumably were no longer available for military service. Deferment of college students in wartime will complicate this matter, and when washers of test tubes in laboratories or even majors in science in college courses are called "scientists," the problem is merely evaded.

Another complication of military manpower is that of physical requirements. The general attitude is that persons are either fit or unfit for military service. At the beginning of World War II, there were classifications of those fit for general military service, those fit for general military service with remediable defects, and those fit for limited military service. Few of the last class were ever called, and hospitalization complicated the second. When there were many complaints about the numbers in Class 4F—those physically unfit for service—an Armed Services Committee saw no opportunity either to use them or to change the standards.

The efficiency or wastefulness of the Armed Forces themselves affect military manpower requirements. The Hoover Commission made references to "inefficiencies" in the Department of Defense, and, obviously, organizations that permit such conditions will be wasteful of manpower (*3*). In 1943 the President publicly criticized the Selective Service System for not furnishing men to the Army. It was discovered later, however, that the Army had already exceeded its authorized strength by several hundred thousand men. The explanation given was that casualties did not occur in the number expected.

There would be no point in knowing the population of the United States or the character and qualifications of its people for the purpose of war or national defense if they could not be located, allocated, utilized, and trained. Volunteering is an ineffective and wasteful system. The approved method of raising armies or meeting military manpower requirements is by induction by a Selective Service System, with a lingering reliance on enlistments that are largely the result of the coercive power of the draft. The Selective Service System was a tremendously popular success both in World War I and in World War II. It achieved its purpose. But the fact that we "won the war" should not be taken as sufficient sanction that what was done was "best." This attitude, unfortunately, has been too general. One perfect example is Troyer Anderson's report on the procurement of munitions by the War Department under the direction of the Under Secretary of War that is entitled "Munitions for the Army." An evaluation of our success in war should recall the reference in the Eberstadt Report that achievement was gained at the cost of much waste of material, manpower, and money.

The Selective Service System in World War I raised by enlistment and induction 4 million persons for the Armed Forces out of a population of 103 million. In World War II, when the balancing of the military and industrial manpower needs became critical, there gradually arose a number of problems that required additional administrative machinery. Among the administrative bodies set up to solve these problems were the War Manpower Commission and the Economic Stabilization Board. There was a very clear indication that the situation required the development of more definite machinery for the control and direction of civilian manpower. Some refinements that were developed in World War I such as special calls for specific needs of the Armed Forces for workmen with particular skills were not used in World War II. A specific policy of "work or fight" was not employed in World War II, although approaches to the policy were used. Persons not physically qualified for military service who were in essential jobs were required to remain there even though, by the normal rules of Selective Service, they were theoretically free. It became necessary, however, to adopt special regulations for "job jumpers" who were able to be inducted after the Army reduced its physical standards in such cases. In World War II, there were many certification plans to aid local boards, the most publicized of which was the West Coast plan for the aircraft industry.

While the primary function of the Selective Service System was to secure men for the military service, the system was also responsible for attempting to maintain the military-industrial balance. Selective Service was obligated to see that the withdrawal of men for military service disturbed the civilian war effort to the least possible extent. As increased demands for men came from the Armed Forces, however, the balance could not be maintained. The absence of policy on the part of the War Department, the lack of an adequate survey of the industrial skills of the country, and the increased demand for manpower in the war industries made a full performance of the task impossible.

Those who were to carry on industrial and agricultural production and the work of the civilian community were men outside the military ages, women, prisoners of war, or imported labor. With respect to military manpower, those who were not physically qualified for military service or who were deferred as necessary by the Selective Service System on an individual basis were also available. Dependency deferments affected large numbers of essential workers. Later, these deferments were withdrawn; this greatly increased the number who were considered directly for industrial and agricultural deferment. These decisions were made by 6443 boards and were reviewed by 1000 appeal boards.

The great weakness of the Selective Service System was lack of a positive policy for industrial and civilian manpower. Although numerous agencies were created to handle this problem, there was little actual coordination between them and the Selective Service System. The creation by Executive Order of the Office of Economic Stabilization (6 October 1942) and the Office of War Mobilization (May 1943) did not clarify or unify manpower policies. Proper organization and administration are needed to integrate into a positive policy all these elements with the new elements that will be made necessary by atomic war. Changes within Selective Service in wartime show a definite trend toward national service. But perhaps a radical reconsideration of the Selective Service System is more than we are prepared to accept (*4*).

It may be that a discussion of military manpower requirements is entirely beside the point. The communists believe that everything can be achieved without a hot war. Armies are not needed when espionage agents, saboteurs, and fronts are successful. An error is often made in distinguishing between the U.S.S.R. as a nation and the Communist International as a world conspiracy and revolutionary movement. Communists use the national status of the U.S.S.R. to deal with other states and are accorded a position in the family of nations that the international conspiracy as such could not obtain. Cold war is communism's constant instrument in its clear, unmistakable, and unwavering purpose: the mastery of the world, the demise of capitalism, and the end of every religion not subsequent to its final purpose. In contrast to the drifting hopefulness and forgetful erring of the noncommunists, the communists never lose sight of their ultimate objective. No military campaign was ever worked out more painstakingly, with more attention to detail, with more careful timing, and with more patience than the seemingly irresistible day-by-day, hour-by-hour action of communists everywhere. They have devised the most subtle and cunning methods of making traitors in every country and of using idealists and the so-called intelligentsia, and their success has indicated no need for war. The threat of war has been a means of creating a state of unrest and insecurity for their enemy and a means of causing a waste of money, manpower, and materials in a mad armaments race for a mythical superiority.

In any case, the net result of a discussion of the military manpower problem should be that it is not a simple problem of numbers. It is not a problem of ratios of the mechanically minded or the compromises of a bureaucracy of budget makers. It goes to the basic characteristics of the people and the economy and to their international policies. It involves the highest type of imagination in procurement, training, and utilization. It builds most certainly on the efficiency of government and of military organization. And above all, the quality of manpower—in sufficient numbers and properly utilized in cold war or hot for the common defense —is the key to our national existence (*4a*).

Human Resources in American Industry

The measure of any nation's strength is in its productivity. Efforts to assign statistical values to industrial strength have not been particularly successful, whether the values are expressed in such monetary terms as gross national product, capital investment, or per capita income, or in such manpower figures as the number of people gainfully employed. Neither money nor manpower gets quite to the crux of the quality to be measured, which is output. Without debatable adjustments, the monetary yardstick inevitably reflects transitory, and sometimes violent, changes in purchasing power. As for the human factor, 65,000,000 gainfully employed workers in the U.S.S.R. or in China have a far lower productive capacity under present conditions than an equal number in the United States.

Industrial strength—and, with it, national security—is compounded of human skill and manufactured energy applied to the processing of available raw materials. No one of these ingredients possesses much intrinsic worth without the other two, and no two of them have sufficed to make or to keep any country great since the industrial revolution relegated manpower, in the literal meaning of the word, to a place of secondary or tertiary significance, and elevated skill, or brainpower, to a place of primary importance.

Unless we wish to embrace the dubious and discredited tenets of racism, we Americans must regard our own people as ordinary human beings with no mental or physical characteristics that are not shared by the human race as a whole. Yet, industrially, we are admittedly the most productive of nations. A look at history must convince Americans that we are descended from common stock and drawn from many sources. Colonial settlement by the English, Dutch, and Swedes was followed by German and Irish immigration. The Congress cut the influx to a trickle when migrants from Italy and eastern Europe became numerically strong. For the most part, immigration was regarded as a means of importing unskilled labor—the "strong backs and weak minds" that would relieve the earlier arrivals and their descendants of menial work.

Somehow, the minds of immigrants never remained weak, for the free educational system of the New Country and the unlimited opportunity offered by the frontier quickly destroyed the vestiges of any caste systems that may have clung to some of the immigrants. The melting-pot theory, according to which the racial mixture imparted unusual vigor and acuity to Americans, lacks substantial supporting evidence. The only tenable conclusion is that the American people have educated themselves out of the category of unskilled, or common, labor and are now in the process of reducing the number of semiskilled workers in labor's ranks.

In broad terms, the 65,000,000 gainfully employed workers in this country engage in the following activities: agriculture, 13 percent; industry, 35 percent; service (including commerce), 45 percent; Government, 4 percent; unclassified, 3 percent.

Classified somewhat arbitrarily on the basis of the caliber of the work performed, America's labor force consists of the following groups: unskilled workers, 12 percent; semiskilled workers, 20 percent; skilled workers, 45 percent; specialized workers, 12 percent; managerial workers, 11 percent.

These generalizations are based on ratios that were determined from the 1950 census, but they involve a few arbitrary decisions concerning what constitutes service as distinct from industrial production, and where to draw boundaries between semiskilled, skilled, and specialized employment. The last of these categories includes teachers and technicians, as well as professional engineers and scientists, who comprise only 1 percent of the working population. The managerial group likewise embraces more than the term normally signifies, for it covers clerks, office workers, and service personnel whose jobs do not call for manual productive or operational skills.

In the course of a century, agriculture has steadily lost ground to industry and commerce, and for

75 years the ratio of common labor has dropped—slowly until World War I, but at an increasing tempo since, especially in the years after the establishment of legislative curbs on immigration. Yet the amount of common labor to be performed has not diminished—on the contrary, it has steadily increased. As on the farms, so in industry: mechanization has replaced "strong backs."

Paradoxically, the initial purpose of mechanization was not to fill in gaps created by shortages of unskilled labor, but rather to effect economies through the elimination of workers. Although it started on the farm with the cotton gin and the reaper, mechanization acquired its greatest momentum during the depression, when labor was in surplus. It furnished the thesis for the abortive economic theory of technocracy, first formulated by William Henry Smyth and later promoted by Howard Scott. Despite organized labor's resistance to technological unemployment, which was allegedly produced by mechanization, labor-saving devices were paramount in solving the manpower shortage that appeared in 1937 and that became acute with our entry into World War II.

Except for the brief sags in industrial activity in 1948–49 and 1954, the labor supply has barely been in balance with the nation's needs since 1939. Mechanization has been extended, this time to fill the human gap, and science and engineering have been taxed with the responsibility of carrying mechanization one step farther—to automation. Whereas mechanization replaced several manual laborers with a single skilled machine operator, automation completely dispenses with the human element in certain mechanical operations. One highly trained maintenance man may substitute for hundreds of workers, after skilled technicians have installed the equipment. Again the cry of technological unemployment is being heard. Again we face an even more drastic change in the composition of our labor force. Because future demand will be for fewer "strong backs" and for many more strong brains, it is pertinent to ask whether we can make this change, which contains some revolutionary elements.

A century ago the untutored but mechanically minded genius could easily invent a labor-saving device in almost any field of industry and transportation. Increasing knowledge and specialization rapidly narrowed the field of invention for everyone except the highly trained and experienced engineer, and since the early stages of World War II, the engineer—who has gone as far in some areas as our knowledge of basic science will permit—has found that basic research and its application must evolve concurrently if he is to make further progress in an increasing number of fields. The result of this discovery has been so extraordinary that it has not yet penetrated public consciousness, nor is it fully appreciated by the scientific professions themselves.

Fifty years ago, the proverbial habitat of the scientist was the university classroom and laboratory—the so-called ivory tower. He looked with distrust and disdain upon the engineer, and the feeling was reciprocated. World War I penetrated the barrier between so-called pure and applied science but did not break it. World War II shattered it, but it had been weakened in the interwar period. It was during the 1920's that geologists were asked to apply their science to the search for petroleum, and the petroleum and chemical industries found increasing uses for the knowledge and versatility of university-bred chemists. Whereas in 1915 most geologists and chemists found employment in teaching and in government bureaus and laboratories, nearly three-quarters of them are now in industry. Biologists have shown the strongest resistance to industrial employment, but the lure of discovery in the drug and other organically based industries is proving too much for them, too.

The effects of the expanding industrial requirements for specialized personnel are now well known. Demand has exceeded supply since the early years of World War II. This year, approximately 23,000 engineers were graduated; 35,000 could have been used. The situation in the sciences, although it is more difficult to reduce to statistics because of the attrition among those who have earned only a bachelor's degree, is no better. In both science and engineering, 20,000 men are needed annually for normal replacements, and nearly 35,000 more are required to keep pace with the technological demands of our expanding economy. The need is compounded each year at about 7 percent. Can it be met? If so, how? If not, what will be the consequences?

Long experience acquired by such organizations as the Educational Testing Service has shown that the distribution of "intelligence," or mental ability, among our young people is a constant and that there is little prospect of raising the ratio of the bright to the mediocre. The latter can acquire competence through education and training, but it is virtually impossible to transform them into the capable, creative people who, through scientific discovery and technological development, will push the American economy above its present level. In the quest for brainpower, therefore, we must focus on the quarter of the high-school population that possesses the highest degree of native intelligence.

Concern has recently been expressed because only half the high-school students who have the mental capacity for higher education actually go to college. For some, financial considerations are the limiting circumstances; but for most, it is a deficiency in motivation. Although any assumption that this entire group should be college-educated is gratuitous, it is an obvious pool of brainpower of which maximum use must be made if we are to maintain the present rate of industrial and economic growth. The complex problem of motivation is clearly an area for immediate research, but even with our present imperfect knowledge it is plain that there will be no simple answer. Sex, racial discrimination, high-school training, social traditions, and environment, as well as money, are involved.

Yet thoughtful research that isolates the multiple facets in motivation is likely to prove rewarding, not only in revealing criteria for the identification of leaders who will maintain the tempo of our national growth, but in delineating the educational needs of the less able. For all the thought that has gone into public education, especially since secondary schooling has become the norm for three-quarters of our young people, at least part of our educational theory was created in a vacuum. It is commonly described as training for life, or life adjustment, but one sometimes marvels at the sheltered lives many of our educational theorists appear to have led. We live in an age of science and technology and under a competitive system. But many of our able youngsters complete high school without any knowledge of science and without the background for higher education; the less able are no better prepared for the competitive life that awaits them in an industrial civilization. Yet to the former we must turn for inventive genius and leadership, and to the latter for the productivity that has given us our pre-eminence among the nations of the world.

We must not, to be sure, prostitute our educational system by converting it to vocationalism, but we should adapt the instruction given in our schools not merely to the environment in which we live but to the one on which our future as a nation depends. Like some of our journalists, advertising agencies, and movie magnates who have cynically geared their products to 12-year-old mentalities, our educators have too often debased elementary and secondary instruction to an assumed common denominator of intelligence as a basic principle in "mass education." The critics of this statement—and there will be many—are invited to study the charges made by the growing number of educators who have become concerned with our neglect of the able students. And even these educators underrate the mental capabilities of the many who, despite mechanization and automation, must do the world's work as skilled or semiskilled workers or technicians. They overlook the historical fact that, within a century, all but 12 percent of our population—and most of them underprivileged—have been educated out of the category of unskilled laborers; that semiskilled workers are growing scarcer, in large part because American industry has discovered a higher mental potential in our human resources than is developed in our schools. It is a strange and paradoxical world in which industry is doing more than education to develop the human potential.

Let us recall that this change in the complexion of American labor has occurred without any demonstrable improvement in native intelligence or in the ratio of the bright to the average. There has, however, been a steadily rising demand for talented people who, in response, have turned out in larger numbers than would have been predicted 50 years ago. In 1900, for example, industry employed but one engineer for every 300 workers. Now it is one for every 60. As recently as 1920, a scant 10 percent of our scientists served industry; now nearly 50 percent are finding new chemical compounds, devising new power plants, thwarting plant pests, discovering oil, or inventing computers. Where has so much talent come from? From our farms, where science and invention have drastically cut the need for manpower, and from our second-generation immigrants, whose fathers had no opportunity to cultivate their brains. If we are concerned that half of the upper quarter of our high-school graduates are not going to college, let us remember that the percentage of our best high-school graduates now entering college has risen steadily since 1900. In fact, the ratio of those now receiving doctor's degrees is not far from the ratio of those who merely earned bachelor's degrees 55 years ago.

Nonetheless, we are short of highly trained personnel in nearly every field, even though a substantially higher proportion of our more capable students are entering institutions of higher learning. Although prediction is hazardous, simple projection of the curve of increasing brainpower utilization across the reservoir of brainpower available reveals the disturbing fact that the need will soon exceed the supply, even on the assumption that everyone in the pool will make himself available. What then? We can still stretch our normal labor supply through more and better education and through automation. We do not have this option, however, in cultivating the brainpower we need to maintain the pace set by our expanding economy. Unless we wish to stabilize our economy involuntarily at a level determined by the manpower-brainpower ratio—which appears to be a constant—we have but one expedient: we must place increasing dependence on brainpower abroad, not by importing it but by integrating our technology with that of other nations.

International cooperation and integration are, to be sure, temporary expedients, but they appear to be the only ones immediately available. Just as the "underdeveloped" countries are finding their progress retarded by inadequacy of capital and developed energy, so the United States can foresee a finite limit to its human resources and, specifically, to its reservoir of leadership and brainpower. When the limit is reached, the ascending curve of our productivity will level off unless we are prepared to move beyond our national boundaries for human resources as freely as we do now to meet certain of our raw material needs. Imperialism and colonialism are no longer acceptable as means of solving national problems or meeting domestic deficiencies. Hence we must anticipate a new kind of internationalism that transcends the defensive alliances in our present troubled world. This concept of internationalism will involve sharing our strength and our standard of living equally with those allies who are able and willing to help us maintain them.

Manpower and the Economy of the U.S.S.R.

A large population is by itself an economic asset. This proposition is not refuted by the usual reference to the prosperity of some small countries and misery of some large ones, a comparison that only suggests that quantity is by far not the only criterion. But other conditions being equal, a larger population mustering a larger manpower is economically superior to smaller population and manpower. About the same idea can be expressed also in the following form: a national economy, uniting large human and natural resources, is much stronger—in war and in peace—than one in which the same resources are split under several national economies. The Soviet Union's recent history illustrates these almost obvious comments.

The Soviet Union has at its disposal both rich natural resources and vast manpower. But up to the 1930's their utilization was extremely poor. The mighty Russian Empire, with all its splendor and achievements in arts and sciences, was basically a backward agricultural country. The developed resources were meager; the grade of mechanization was low in all sectors of the economy; and the technically trained cadres were trifling for a nation covering one-sixth of the globe. What old Russia needed above all can be expressed in one word: industrialization.

Only late in the 19th century were taken the first resolute steps toward utilizing Russia's rich natural resources, and even then the matter was not steadily pursued. On the eve of World War I, industrial development came in full swing. But it was too late; the inadequacy of Russia from an industrial point of view led to defeat—the event which preceded revolution and communist seizure of power. Through civil war and nationalization, the economy of the U.S.S.R.—particularly the young extracting and manufacturing industries—received a severe blow from which recovery was slow. With the introduction of the 5-year plans, industrialization was rigorously resumed in a new form—ruthless state capitalism that was covered by socialist verbiage about the interests of the working class.

In the early 1930's, industrialization was intimately connected with collectivization of agriculture. Communist terror against well-to-do peasants and famine resulting from enforced collectivism drove millions of peasants to urban centers, where they found employment in industries that developed rapidly with the help of capital investment squeezed out of the rural economy. As mechanization of agriculture progressed (this was the only positive aspect of collectivization) farm manpower requirements were reduced, and such reductions built up new masses of superfluous *kolkhozians* (collective farmers). Despite millions who had perished in connection with collectivization, and even larger numbers who were absorbed by the cities, there was still in 1940 in the *kolkhozes*, according to an official estimate, a surplus labor force of 5 million. This remainder of an inveterate disease—for agrarian overpopulation in Russia dates back to the time before the liberation of the serfs —was liquidated by the huge military and civilian casualties in the war with Germany, combined with a persisting demand of industry for additional hands.

The long-overdue Industrial Revolution took root in Russia more suddenly and subsequently developed at a much faster pace than it did in other Western countries. And since its promoters were totalitarian communists, it lacks some aspects that are considered to be characteristic of the entire Industrial Revolution: the liberation of the individual and the spread of political freedom, both of which are indispensable to engender the required animation of economic activities. Up to now, the experience of the U.S.S.R. seems to refute such a general characteristic and attempts to show that a regimented economy can be substituted for the incentives offered by the fruit of free individual activity, at least to a certain degree, by growing opportunities for socioeconomic ascent. Whether or not this reversal of the Western experience is temporary or permanent remains to be seen.

Still we meet in the U.S.S.R. the familiar economic-demographic traits of the Industrial Revolution. From the fifth or sixth place occupied up to World War I, the U.S.S.R. has advanced to the position of an industrial world power, second only to the United States. In the short span of the last 30 years, the proportion of the urban population has more than doubled, an increase of from 18 percent to 40 percent of the total population. The number of nonagricultural workers has risen more than 4 times, from 9.5 million to 41 million. The number employed in agriculture has dropped from more than 80 percent to some 40 to 45 percent of the total labor force.

The agricultural population is still extremely high and it represents an enormous mass of about 50 million, whereas in the United States, farming on an area of similar dimensions is done by less than 8 million, who constitute only some 12 percent of the total labor force. The contrast between U.S.S.R. and American figures has given rise to comments emphasizing the enormous waste of manpower in Soviet agriculture. And certainly waste there is, but it should not be exaggerated. The U.S.S.R. requires a much larger agricultural manpower, even under careful use. Despite the dimensions of the surface covered by the Soviet Union, the amount of good arable land is limited, particularly as a consequence of climatic conditions. Excepting the most southern areas, which are largely unsuitable for agriculture, the relative geographic position of the U.S.S.R. is north of the parallel that borders the northern United States; this restricts farm land area. To feed a large and growing population, the U.S.S.R. has been forced to expand cultivation over marginal land. As Huntington and Valkenburg have stated, the U.S.S.R. utilizes agricultural possibilities more fully than the United States. If New England and northern New York were in the Soviet Union, the abandoned farms would undoubtedly be cultivated to yield more than the average Soviet Union yield. True, productivity per man hour is promoted by progressive mechanization. But the machinery the U.S.S.R. has at its disposal does not equal the equipment of American farms. Nor should the figure of 50 million people who work in the fields of the Soviet Union be taken at face value, for what counts is not only their number but also their composition by age and by sex. War losses have particularly affected the male population in the working ages, and in the postwar period industry has continued to siphon off the young male generation from the countryside. Observers have been awed by the masses of women working in the fields who, in addition, do all the menial chores. Indeed, the farm labor force, 50 million strong, includes less than 20 million males in the working ages of 16 through 59. The balance of the force is composed of women, youngsters below 16, and old people (*5*).

The remaining factors responsible for the Soviet Union's superfluous agricultural manpower are lack of know-how and defective organization, in particular the mass of parasitic administrators of socialized agriculture. The slight improvements that are being achieved in this regard and the steady increase in mechanization have tended to reduce the manpower requirements for food and other agricultural production. The rural population, therefore, certainly will continue to function as a reservoir from which expanding industry draws additional manpower. The process goes on in two ways. One is rural-urban migration of adults looking for employment. The other is recruitment of boys and girls in the ages of 14 to 17 for training in factory, handicraft, and railway schools. Altogether, industrialization attracts to the cities a number of migrants equivalent to the entire natural increase of the rural population.

Industrial development has been the prime mover behind the rapid pace of urbanization which, in its turn, has had grave demographic repercussions. Once the peasants were in the cities, their high levels of fertility and mortality began to change—to be shaped by the new urban environment that included not only educational and related opportunities but also better medical facilities and notions about birth control as well as incentives to use them. Although the rural population experienced the consequences of industrialization much less intensely than the city dwellers did, to some extent educational and medical facilities also have been provided in rural areas. And here, too, rationalization of procreation has gained ground, the decrease of fertility being stimulated also by an inadequate number of males in procreative ages.

By the eve of World War II, in the relatively short period of 25 years after World War I, the Soviet Union had almost completed what is known as the "demographic transition." It had passed from a period of very high birth and death rates to one in which the death rate was relatively low while the birth rate, although declining too, remained high. After the end of World War II the trend was resumed, and recently the final stage of the demographic transition has set in. The death rate has reached such a low level that a further decrease will be very difficult to achieve, and the birth rate has fallen at a more rapid pace than the death rate. In other words, the natural rate of increase of the population, although still high, has been slowing down.

These demographic changes, however, although they are of great consequence for the future, will not at once be reflected in the size of the labor force of the U.S.S.R. At present, large age cohorts are still entering the labor market—those born after the famine caused by collectivization was already over. Only after 1960 will the birth deficit of the war years become fully apparent in reduced cohorts of young workers. These cohorts will be followed by the relatively normal postwar cohorts who reflect a much higher, although decreasing, fertility.

To summarize a quantitative approach, the human resources of the Soviet Union are adequate for the requirements of the economy; no deterioration is visible in the immediate future, particularly since progress in agriculture will continue to release manpower. True, in the last 3 years, to meet increased demands for food, contingents of urban workers have been directed to Kazakstan and other regions where reclamation of virgin lands is in process. The number of these urban-rural migrants, however, is relatively small—hardly more than 50,000 a year. It is rather their qualification as mechanics and other specialists that makes their cooperation valuable and their moving noticeable. But here we touch the qualitative aspect of U.S.S.R. manpower.

The approach to the question of the qualitative strength of the Soviet Union's manpower usually oscillates between two extremes. One is condescending underevaluation — Western civilization technically equipped and based on scientific reasoning against a traditionally half-barbaric Slavic Orient. This approach lulls us into security, whatever might be the numerical strength of Soviet Union manpower. The other extreme, which recently has become more and more prevalent, is that of an excessive overestimation of achievements and possibilities. A sober analysis rejects both extremes not only because they are defective as are almost all extremes but also because they are products of superficial generalization.

The U.S.S.R. is a land of contrasts, of modern skyscrapers and miserable huts, of almost perfect machinery and primitive implements, of grandiose technological progress and scarcity of the most simple and the most necessary things. By way of example, an anecdote circulating in the Soviet Union ridicules a propagandist who extolls Soviet achievements. The Americans, the propagandist says, boast of having so many cars; but communist industry will soon provide every citizen of the U.S.S.R. with his own airplane. When someone in the audience interjects, "What do I use it for?" the speaker explains: "Suppose you have holes in your socks, but you cannot get a needle to mend them. Now you are told that needles are being sold in Kharkov. You take your plane, fly to Kharkov, and the same day you bring home a full dozen needles, and your wife can mend the socks." The moral of the anecdote, of course, relates to a serious economic problem. Concentrating on military requirements, means of production, and some other objectives, the manufacturing industries of the U.S.S.R. are unable to cover even minimal demands for housing, household goods, and other consumer items. One reason for this situation is capital shortage. Another is a shortage of adequate manpower. But where is this shortage located? It has been noted that U.S.S.R. industry has a sufficient supply of unskilled labor. But what about the ranks of skilled labor and the professions?

According to Lenin's famous statement made immediately after the Communist seizure of power, every charwoman would be qualified to govern the nation and to administer its affairs. The Communist leaders themselves have been of diverse educational levels. But to administer the economy of the U.S.S.R. and to develop natural resources, they relied not on the charwomen but on the old Russian specialists and the new cadres trained by them.

The Soviet Union's views concerning old Russia went through two stages. At first the communists painted everything prerevolutionary in black, presenting whatever there was valuable in the Soviet Union as socialist achievement. Then, reversing their attitude, they arrogated Russia's past as a forerunner of the Soviet Union's glory, and in an extremely ridiculous way claimed priority in any scientific discovery or technological invention. In rejecting the nonsense of Soviet propaganda, however, it should be recognized that old Russia's achievements were great not only in arts but also in the sciences. In particular, in the atomic age, it is only fair to remember the name of Mendeleev, author of the periodic table of the elements, on whose teachings the doctrine of the atom was based for several decades.

The Soviet Union inherited the Russian intelligentsia, whose intellectual and moral standing was very high. The communist rulers persecuted individual scholars and technicians for political reasons and probably corrupted a great number of them. But they have been eager to preserve and develop their scholarly and technical abilities. Only in a few places in the world does the scholar as well as the artist enjoy such a privileged material position as he does in the Soviet Union, albeit they remain, like all Soviet peoples, slaves of the communist dictators. In general, learning is parallel to Communist party activity; it is the main road to Soviet "prosperity." As such, it attracts the Soviet youth in ever growing numbers, especially toward science and technology. The number of professionals in higher education is impressive, even if it is compared with that of the United States. There are some 540,000 engineers in the Soviet Union against about 560,000 in the United States (the Soviet figure also includes architects); 337,000 physicians and other personnel in the medical field against about 400,000 in this field in the United States; and approximately 857,000 persons with college degrees in education against some 1,300,000 in the United States. Still more impressive is the growth of the number of professionals in the U.S.S.R. Since 1940, the number of engineers has almost doubled. The same growth applies to the agricultural and socioeconomic fields, while the numbers of physicians and teachers has nearly tripled. And, as experts attest, this quantitative gain has come by no means at the cost of quality.

It should be noted that the U.S.S.R. has a fair and rapidly increasing number of scholars and professionals at the higher levels and a sufficient reservoir of unskilled labor at the lower levels. In the middle layer, however, is found the Soviet Union's shortage of manpower. This shortage is noticeable when we go from the professional labor force to the semiprofessional; and still more serious are the insufficient numbers of skilled workers. This, too, is an inheritance from old Russia. Even when the Russian economy required only 1 million or so skilled workers, they were not available. There is not a sufficient supply of this type of labor now when the U.S.S.R. needs some 20 or 30 million of them. And there are other areas than manufacturing in need of skilled labor. Moscow propagandists boast that the Soviet Union uses the most modern machinery in all sectors of the national economy. Even if we make allowances for exaggeration, the demand for trained mechanics to handle machinery is certainly very great. The use of manpower in the *kolkhozes* can be curtailed only by use of agricultural machinery that is operated by skilled workers. As has been noted, the expansion of the agricultural areas depends too on the problem of skilled handlers of farm equipment. In addition, in the Armed Forces, almost every soldier must be a technician of some kind.

The Government of the U.S.S.R. is attempting to meet this demand for skilled labor. Trade, railroad, mining, and factory schools turn out 300 to 350 thousand graduates yearly. But we may well be skeptical when we are told that, in addition to these boys and girls, the "qualifications" of 7 million factory and office workers were "raised" in 1950 by means of individual and brigade apprenticeship and course training, and that again three years later 7.7 million workers altered their qualifications or received instruction. To speak of "raising qualifications" can mean anything. That which certainly has been raised is the foundation of technical progress—the level of general education. The entire youth is enrolled in the 7-year school course, and expansion to a general 10-year school is under way. But despite all the efforts of the government and despite the substantial achievements that cannot be denied, the shortages of skilled workers remains a weak point in the economy of the Soviet Union.

Here lies the explanation of so many achievements and shortcomings in the U.S.S.R. The Soviet Union can reach the summits in atomic weapons production or in airplane building because there are outstanding scientists and technological inventors in the nation and because it can supply these privileged industries with the required amount of skilled labor. But it can not do the same in all sectors of industry. This explains—apart from the capital investment problem—why spectacular achievements go hand in hand with the most primitive conditions of life in the Soviet Union.

References and Notes

1. K. von Clausewitz, *On War,* translated by Graham and Maude (London, 1918), Book 8, Chap. 6B.
2. Strategy is used here as E. M. Earle uses it in *Makers of Modern Strategy.* Up to the end of the 18th century, strategy was merely a body of stratagems and tricks (*ruse-de-guerre*) to deceive the enemy and win victory. "But," Earle states, "as war and society become more complicated, . . . strategy of necessity has required increasing consideration of non-military factors —economic, psychological, moral, political, and technological" (p. viii). Strategy is not merely a concept for wartime, therefore, but an element inherent in statecraft at all times (Earle).
3. For further reference see: U.S. Director of Selective Service (Lewis B. Hershey), *Selective Service in Wartime,* Ed. E. A. Fitzpatrick (Government Printing Office, Washington, 1943).
4. E. A. Fitzpatrick, *Universal Military Training* (McGraw-Hill, New York, 1945).

4*a*. Condensed from the original statement.

5. At a recent reception for the U.S. Farm Delegation in Moscow, the Minister of Sovkhozes, Benediktov, announced a figure of 27 million "able-bodied" workers in the *kolkhozes, sovkhozes* (state farms), and machine tractor stations.